

Advanced Ablator Thermal Model (Advanced Material Modeling)

Completed Technology Project (2012 - 2017)



Project Introduction

Building models that are based on fundamental understanding of the material behavior, coupling those models to the fluid dynamic behavior of the boundary layer, and validating the model with arc jet and flight data will enable optimized risk and margin recommendations for a whole generation of future NASA and commercial space missions.

Anticipated Benefits

NASA funded: Deliver high fidelity TPS response models with direct impact to MPCV and Mars 2020 TPS margin policy and system mass. Improve prediction of Mars entry environments and TPS response to facilitate instrumentation selection and placement and analysis of returned data for MEDLI-2. NASA unfunded: Deliver new TPS modeling capabilities which will increase fidelity and reduce uncertainty, margin and system mass for TPS design for future missions. OGA: Ablative TPS response and gas-phase reactive chemistry modeling improvements directly benefit DoD through an active partnership with AFOSR. NASA (ESM), AFOSR and Sandia National Laboratory currently co-sponsor an annual workshop on ablation modeling that is attended by more than 70 people from multiple government agencies, industry, and academia. Commercial: All of EDL Modeling and Simulation is of direct benefit to commercial space. Commercial companies generally rely on NASA developed tools for in-house EDL analysis (including TPS response), and thus directly benefit from improvements to those tools. SPACE-x has begun the process of acquiring PATO, and other commercial industry partners will follow. Nation: EDL Modeling and Simulation is an enabling capability for spaceflight. Our ability to conduct larger and more complex missions is limited first and foremost by cost, which is a strong function of how well we understand the required system performance. By developing higher fidelity, more accurate predictive M&S capability we enable the customer to make better informed decisions and to better understand performance limits of current and future technologies. A natural consequence is increased reliability, lower mass, and a better understanding of when a fundamentally new technology is in fact required to meet mission objectives.



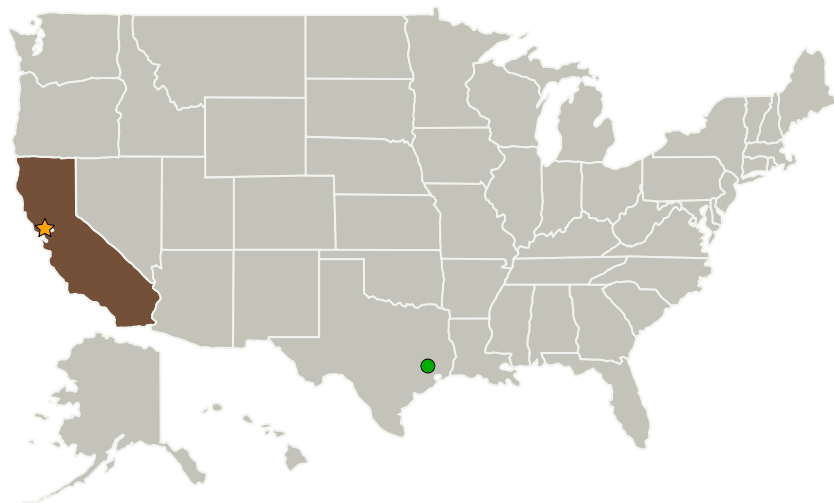
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Primary U.S. Work Locations and Key Partners



Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Game Changing Development

Project Management

Program Director:

Mary J Werkheiser

Program Manager:

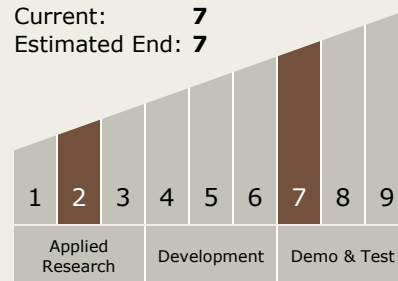
Gary F Meyering

Principal Investigator:

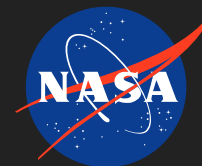
Michael J Wright

Technology Maturity (TRL)

Start: 2
Current: 7
Estimated End: 7



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Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Air Force Office of Scientific Research(AFOSR)	Supporting Organization	US Government	Arlington, Virginia
EADS Astrium GmbH	Supporting Organization	Industry	Outside the United States, Germany
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas
Lawrence Berkeley National Laboratory(LBNL)	Supporting Organization	R&D Center	Berkeley, California
Montana State University - Bozeman	Supporting Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH)	Bozeman, Montana
National Science Foundation	Supporting Organization	US Government	
Sandia National Laboratories(SNL)	Supporting Organization	R&D Center	Albuquerque, New Mexico

Target Destination

Mars

Primary U.S. Work Locations

California

Project Transitions

**October 2012:** Project Start

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September 2017: Closed out

Closeout Summary: Various software codes are assessed at different TRLs within this technology element. PATO is TRL7. PUMA is TRL7. Icarus is TRL6.

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>